

## IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/3/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

**We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.**

### AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 3/3/21 9 a.m.

**Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.**

**Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.**

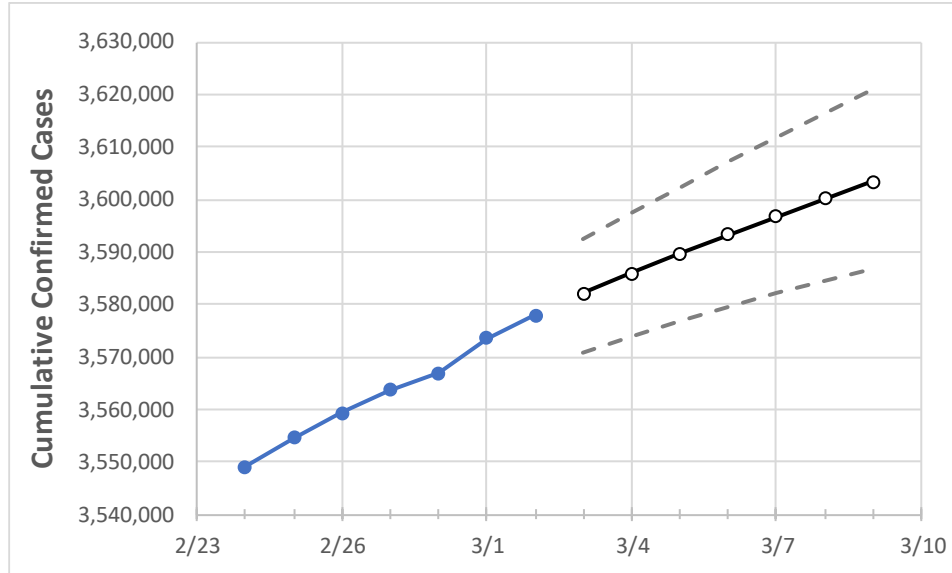
### IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

California State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
California	3,563,578	3,566,914	3,573,549	3,577,966	3,582,060	3,585,943	3,589,700	3,593,289	3,596,802	3,600,142	3,603,309	

*Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.*

California Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Alameda	80,496	80,668	80,777	80,873	80,958	81,039	81,112	81,186	81,249	81,315	81,376	
Contra Costa	62,220	62,248	62,720	62,818	62,926	63,034	63,134	63,234	63,327	63,418	63,512	
Fresno	95,202	95,393	95,548	95,677	95,812	95,944	96,069	96,189	96,308	96,425	96,540	
Kern	103,025	103,223	103,422	103,622	103,775	103,921	104,062	104,200	104,324	104,451	104,570	
Lake	3,153	3,156	3,164	3,164	3,172	3,180	3,188	3,195	3,202	3,209	3,216	
Los Angeles	1,190,894	1,191,923	1,192,954	1,194,333	1,195,517	1,196,664	1,197,756	1,198,805	1,199,797	1,200,773	1,201,716	
Marin	13,184	13,207	13,231	13,261	13,281	13,301	13,321	13,339	13,358	13,377	13,395	
Monterey	42,200	42,230	42,261	42,316	42,349	42,380	42,410	42,437	42,462	42,487	42,511	
Orange	261,022	261,220	261,408	261,608	261,794	261,967	262,129	262,286	262,435	262,573	262,703	
Placer	19,796	19,828	19,861	19,882	19,908	19,934	19,958	19,983	20,006	20,028	20,050	
Riverside	289,558	289,665	289,773	290,325	290,482	290,624	290,758	290,887	291,003	291,117	291,226	
Sacramento	93,180	93,281	93,528	93,678	93,819	93,957	94,093	94,232	94,351	94,477	94,591	
San Bernardino	286,291	286,607	286,755	286,814	287,023	287,218	287,408	287,587	287,756	287,921	288,072	
San Diego	259,641	260,091	260,625	261,001	261,374	261,724	262,066	262,402	262,711	263,007	263,300	
San Francisco	34,213	34,260	34,291	34,318	34,360	34,402	34,442	34,480	34,517	34,549	34,581	
San Joaquin	66,699	66,764	66,829	67,040	67,125	67,211	67,292	67,372	67,448	67,523	67,594	
San Luis Obispo	19,654	19,675	19,696	19,724	19,750	19,773	19,796	19,818	19,839	19,858	19,877	
San Mateo	38,922	38,998	39,059	39,096	39,161	39,224	39,285	39,342	39,399	39,456	39,510	
Santa Barbara	31,791	31,805	32,050	32,087	32,142	32,193	32,242	32,290	32,335	32,377	32,418	
Santa Clara	110,422	110,621	110,755	110,911	111,082	111,251	111,410	111,565	111,714	111,861	112,002	
Santa Cruz	14,630	14,650	14,671	14,700	14,718	14,734	14,751	14,767	14,783	14,797	14,812	
Solano	30,054	30,085	30,115	30,163	30,191	30,217	30,243	30,268	30,292	30,314	30,335	
Sonoma	28,063	28,141	28,193	28,222	28,272	28,321	28,370	28,417	28,464	28,511	28,555	
Ventura	77,534	77,623	77,749	77,849	77,936	78,021	78,100	78,176	78,245	78,311	78,373	

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

### California Medical Demand by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	2/27	2/28	3/1	3/2	3/4				3/6				3/8			
Alameda	80,496	80,668	80,777	80,873	81,039	(16,208)	[3,890]	{1,945}	81,186	(16,237)	[3,897]	{1,948}	81,315	(16,263)	[3,903]	{1,952}
Contra Costa	62,220	62,248	62,720	62,818	63,034	(12,607)	[3,026]	{1,513}	63,234	(12,647)	[3,035]	{1,518}	63,418	(12,684)	[3,044]	{1,522}
Fresno	95,202	95,393	95,548	95,677	95,944	(19,189)	[4,605]	{2,303}	96,189	(19,238)	[4,617]	{2,309}	96,425	(19,285)	[4,628]	{2,314}
Kern	103,025	103,223	103,422	103,622	103,921	(20,784)	[4,988]	{2,494}	104,200	(20,840)	[5,002]	{2,501}	104,451	(20,890)	[5,014]	{2,507}
Lake	3,153	3,156	3,164	3,164	3,180	(636)	[153]	{76}	3,195	(639)	[153]	{77}	3,209	(642)	[154]	{77}
Los Angeles	1,190,894	1,191,923	1,192,954	1,194,333	1,196,664	(239,333)	[57,440]	{28,720}	1,198,805	(239,761)	[57,543]	{28,771}	1,200,773	(240,155)	[57,637]	{28,819}
Marin	13,184	13,207	13,231	13,261	13,301	(2,660)	[638]	{319}	13,339	(2,668)	[640]	{320}	13,377	(2,675)	[642]	{321}
Monterey	42,200	42,230	42,261	42,316	42,380	(8,476)	[2,034]	{1,017}	42,437	(8,487)	[2,037]	{1,018}	42,487	(8,497)	[2,039]	{1,020}
Orange	261,022	261,220	261,408	261,608	261,967	(52,393)	[12,574]	{6,287}	262,286	(52,457)	[12,590]	{6,295}	262,573	(52,515)	[12,603]	{6,302}
Placer	19,796	19,828	19,861	19,882	19,934	(3,987)	[957]	{478}	19,983	(3,997)	[959]	{480}	20,028	(4,006)	[961]	{481}
Riverside	289,558	289,665	289,773	290,325	290,624	(58,125)	[13,950]	{6,975}	290,887	(58,177)	[13,963]	{6,981}	291,117	(58,223)	[13,974]	{6,987}
Sacramento	93,180	93,281	93,528	93,678	93,957	(18,791)	[4,510]	{2,255}	94,232	(18,846)	[4,523]	{2,262}	94,477	(18,895)	[4,535]	{2,267}
San Bernardino	286,291	286,607	286,755	286,814	287,218	(57,444)	[13,786]	{6,893}	287,587	(57,517)	[13,804]	{6,902}	287,921	(57,584)	[13,820]	{6,910}
San Diego	259,641	260,091	260,625	261,001	261,724	(52,345)	[12,563]	{6,281}	262,402	(52,480)	[12,595]	{6,298}	263,007	(52,601)	[12,624]	{6,312}
San Francisco	34,213	34,260	34,291	34,318	34,402	(6,880)	[1,651]	{826}	34,480	(6,896)	[1,655]	{828}	34,549	(6,910)	[1,658]	{829}
San Joaquin	66,699	66,764	66,829	67,040	67,211	(13,442)	[3,226]	{1,613}	67,372	(13,474)	[3,234]	{1,617}	67,523	(13,505)	[3,241]	{1,621}
San Luis Obispo	19,654	19,675	19,696	19,724	19,773	(3,955)	[949]	{475}	19,818	(3,964)	[951]	{476}	19,858	(3,972)	[953]	{477}
San Mateo	38,922	38,998	39,059	39,096	39,224	(7,845)	[1,883]	{941}	39,342	(7,868)	[1,888]	{944}	39,456	(7,891)	[1,894]	{947}
Santa Barbara	31,791	31,805	32,050	32,087	32,193	(6,439)	[1,545]	{773}	32,290	(6,458)	[1,550]	{775}	32,377	(6,475)	[1,554]	{777}
Santa Clara	110,422	110,621	110,755	110,911	111,251	(22,250)	[5,340]	{2,670}	111,565	(22,313)	[5,355]	{2,678}	111,861	(22,372)	[5,369]	{2,685}
Santa Cruz	14,630	14,650	14,671	14,700	14,734	(2,947)	[707]	{354}	14,767	(2,953)	[709]	{354}	14,797	(2,959)	[710]	{355}
Solano	30,054	30,085	30,115	30,163	30,217	(6,043)	[1,450]	{725}	30,268	(6,054)	[1,453]	{726}	30,314	(6,063)	[1,455]	{728}
Sonoma	28,063	28,141	28,193	28,222	28,321	(5,664)	[1,359]	{680}	28,417	(5,683)	[1,364]	{682}	28,511	(5,702)	[1,369]	{684}
Ventura	77,534	77,623	77,749	77,849	78,021	(15,604)	[3,745]	{1,873}	78,176	(15,635)	[3,752]	{1,876}	78,311	(15,662)	[3,759]	{1,879}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.